Bio-Optical Instrumentation for Mapping of the Upper Ocean Using SeaSoar

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LONG-TERM GOALS

The implementation of an integrated physical/bio-optical SeaSoar system provides the ability to obtain highly resolved spatial maps of the variability of inherent bio-optical properties within the context of detailed physical structure and dynamics. This capability is important for:

- Examining the interaction between physical and bio-optical responses of the upper ocean to atmospheric forcing.
- Observing the details of bio-optical influences of instabilities, secondary circulations and vertical motions associated with upper ocean fronts.
- Providing statistically meaningful spatial mapping of optical parameters for ground truthing of optical remote sensors.

OBJECTIVES

The objectives of this effort are to:

- Implement a SeaSoar configuration equipped with sensors for obtaining inherent optical properties.
- Utilize this capability in the study of seasonal forcing of the upper ocean in the Japan/East Sea.
- Examine the bio-optical variability associated with the subpolar front and with the shelf/basin transition in the Japan/East Sea.

APPROACH

The instrumentation will be deployed on the Woods Hole SeaSoar and on a vertical profiling system for obtaining inherent and apparent optical properties. The SeaSoar will be repeatedly towed in radiator patterns in the vicinity of the subpolar front to observe the structure and dynamics of physical and optical properties associated with the front. These observations will obtained simultaneous with remote sensing observations (R. Arnone, NRL), meteorological observations (C. Dorman, SIO), and upper ocean chemistry (S. Yang, Kwangju University).

WORK COMPLETED

The WETLabs Hi-Star and HOBILabs Hydroscat-6 have been integrated with the Wood Hole SeaSoar (Figure 1). This SeaSoar configuration was tested during a 3-day test cruise from Woods Hole to

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Georges Bank in October 1998. The vertical profiling package which will carry a CTD, inherent and apparent optical sensors is currently under construction and is expected to be completed by January 1999.

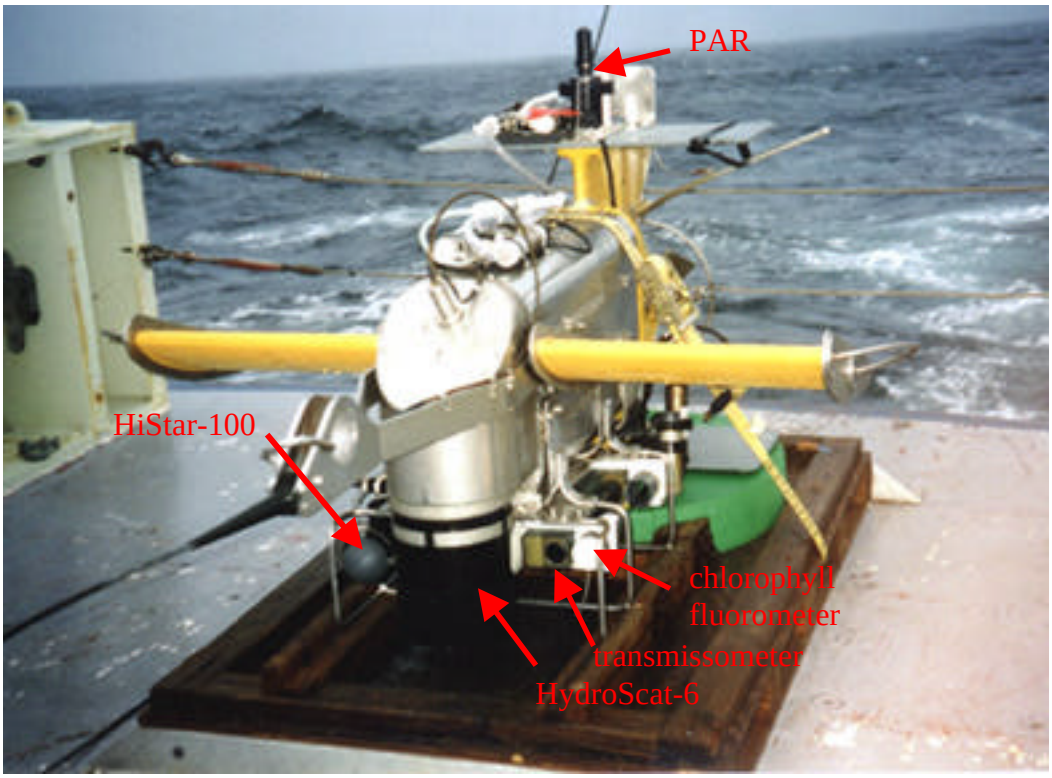

Figure 1. SeaSoar configured for the Japan/East Sea Experiment. Note the payload cage beneath the vehicle and the Hydroscat-6 mounted vertically in the nose assembly.

RESULTS

The test cruise was successful in terms of the overall performance of the SeaSoar system with the newly added optical sensors. The flight characteristics of the SeaSoar were very good despite the added payload and possible hydrodynamic complications. The data acquisition for the optical sensors worked very well and provides for a display of the vertical absorption, attenuation, and backscatter spectra in 15 minute averages (approximately one SeaSoar flight cycle, 0-350 m at 8 knots). Some problems were found in the Hi-Star, but these have been repaired by the factory and should not be a problem during the operational deployment.

IMPACT/APPLICATION

This implementation demonstrates the feasibility of this application of the optical sensors and should provide powerful tool for the study of bio-optical responses to frontal dynamics, upper ocean forcing and coast/open ocean transitions.

TRANSITIONS

This a model for others to use, as well as providing a SeaSoar platform which can be used for an array of coastal and open ocean oceanographic problems.

RELATED PROJECTS

This system will be used as part of the ONR Japan/East Sea study which includes not only our project but several other studies which we hope to collaborate either the sea-going measurement phase or in the analysis phase of the project.

Physical and Optical Structures in the Upper Ocean of the East (Japan) Sea, C. Lee (UW), K. Brink (WHOI) and B. Jones (USC).

Satellite Characterization of Bio-Optical and Thermal Variability in the Japan/East Sea, B. Arnone, (NRL).

Atmospheric Forcing and its Spatial Variability over the Japan/East Sea, R. Beardsley, A. Rogerson (WHOI) and C. Dorman (SIO).

Studies of Physical and Biological Processes in the Japan/East Sea using Coupled Numerical Models, C. Paulson (Purdue University) and L. Kantha (University of Colorado).

Glider Surveys of the Japan/East Sea Circulation, C. Eriksen (University of Washington).

Optical Properties as Tracers of Water Mass Structure and Circulation, G. Mitchell, D. Stramski and P. Flatau (SIO).

Modeling Support for CREAMS II: Oceanic and Atmospheric Mesoscale Circulation and Marine Ecosystem Simulations for the Japan/East Sea, C. Mooers and S. Chen (University of Miami).

Wind Forcing of Currents in the Japan/East Sea, P. Niiler (S.I.O.), D. Lee (Pusan National University) and S. Hahn (National Fisheries Research and Development Institute).

Observations of Upper Ocean Hydrography and Currents in the Japan/East Sea using PALACE Floats, S. Riser (University of Washington).

Hydrographic Measurements in Support of Japan/East Sea Circulation, L. Talley (SIO).

Shallow and Deep Current Variability in the Southwestern Japan/East Sea, R. Watts and M. Wimbush (University of Rhode Island).